Mining Human Activity Patterns From Smart Home Bigdata For Helathcare Application

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Abstract- *Human activity patterns for health care applications determine uses of frequent pattern mining, cluster analysis and prediction to pitch and analyze energy usage changes to affect by occupants' behavior. It starts by cleaning and preparing the data and then handle frequent pattern mining for discovering appliance-to-appliance associations, i.e., determine which appliances are operating together. Then it uses cluster analysis to determining appliance-to-time associations. With these two processes, the system is able to excerpt the pattern of appliance usage which is then used as an input to the Bayesian network for short-term and long-term activities prediction. This work addresses the need to analyze sensual energy utilization patterns at the appliance level, which is directly, related to human activities. To evaluate the proposed system, this work uses the U.K. Domestic Appliance Level Electricity data set-time series data of power appliances collected from 2018 with the time resolution of 6 seconds for five houses with 109 appliances from Southern England. The data from smart meters are frequently mined in the quantum/data slice of 24 h and the results are maintained across consecutive mining exercises. The results of analyzing human activity patterns from appliance usage to granted in this detailed work along with the efficiency of short and long term predictions.*

Keywords- Big data, smart home, smart meters, smart city, frequent pattern mining, cluster analysis, prediction, health care applications.

I. INTRODUCTION

The demand for health care effects will be greatly concerned by this vast inflow of people to city centers. This extraordinary demographic change places excessive burden on cities to review the traditional approaches of given health services to residents. In relate to the new needs and challenges, cities are currently envelop massive digital transformation in a force to support sustainable urban association and provide healthier environment. Advance of big data mining technologies, which maintain means of processing large amount of data for applicable insights can aid in forgiving how people go about their life. For example, check the changes of appliance control inside a smart home can be used to indirectly determine the person's health based on historical data. Since people's habits are mostly determine by everyday routines discovering these routines allows us to remember anomalous activities that may illustrate people's difficulties in taking care for themselves, such as not preparing a food. The basic correlation between appliance usage inside the smart home and routine activities can be used by health care applications to catch potential health problems. This is not only going to assuage the burden on health care systems, but also providing 24 hour monitoring service that consequently identifies normal and abnormal action for independently living patients or those with self-limiting conditions.

This paper proposes the use of power data from smart meters installed at homes to uncover important action of inhabitants. The proposed model discovers and analyzes readings from smart meters to know action and changes in behavior. Disaggregated power expenditure readings are directly related to the action performed at home. For instance, if the "Oven" is ON, the action of this appliance is most likely related with activity "Preparing Food". The time of this operation may also express the type of the meal such as breakfast or dinner. Furthermore, people often achieve more than one action at the same time such as "To Prepare a Food" and "Learn to Music" or "Watching the TV", which means multiple appliances, is created stable. In this context, to consider consumers' physical energy consumption patterns at the appliance level to expose multiple appliance usages and conclude their operations over short and long term time frames. This is especially possible without additional hardware for the smart meter data have time series approach typically consisting of usage and consumption measurements patterns of composing appliances over a time interval. Such, assert since it is not easy to detect usage assurance among various appliances when their operation imbricate or occur at the same time. Furthermore, deriving correct prediction of human activity pattern is changed by probabilistic relationships of appliance usage events that have effective time intervals.

The main contributions of this paper are as follows:

To propose a human activity pattern mining model based on appliance usage innovation in smart homes. The

model which handle FP-growth for pattern recognition and k-means clustering algorithms is capable of analyze appliance-to-appliance and appliance-to-time associations through additional mining of energy consumption data. This is not only important to regulate activity routines, but also, when appropriate by health care application is capable of catching sudden changes of human activities that require consideration by a health provider.

To apply a Bayesian network for activity prediction based on personal and multiple appliance usage. This is important for health applications that incorporate expression for patients to perform convinced activities based on classical data. For added efficiency of the system, the prediction model integrates probabilities of appliance-to-appliance and appliance-to-time associations thus recognizing enterprise that occur in certain patterns more accurately.

II. LITERATURE REVIEW

Dr. Anjali Mathur, V.Vaishnavi and K.Jigeesha[9]., A framework using a big data analysis on human activity pattern for health prediction research work, big data collected from smart machine have been used to fetch the human activity patterns to improve smart home resident's health status, as there is a lot of economic investment in the digital transformation as an effort to provide healthier environs for people. In these transformation lot of smart devices are equipped around, which gives a big amount of delicate and sorted data that can be used to analyze the health patterns. The work mainly target on analyzing the big data extracted from human activities for frequent pattern mining, cluster analysis, prediction to measure and analyze the energy consumption changes appropriately by occupants.

Priya S patil and Syeda Asra[14]., Big data applicable for a human health from mining activity pattern in migration of the people from villages and unsophisticated areas to cities has been a common issue in the present day life. The people get injured, affected and diseased on the cities when it don't take insurance and doesn't have good life style. In this case the need of the health care systems plays an essential role. A Frequent pattern based patient data mining, data clustering, analysis and data prediction approach has been proposed in this work. Analyze and to part of the change in the energy usage of the holder behavior. As user habits will decide their health, the proposed work will path on the routine of the people and manage the acquired data.

Jubil T Sunny,Sonia Mary George and Jubilant J Kizhakkethottam[5]., Applications and Challenges of Human Activity Recognition using Sensors in a Smart Environment currently using smart phone sensors to detect physical movement. The sensors which are presently being used are accelerometer, gyroscope and barometer. Newly smart phones supplied with an easy set of sensors are analyzed as alternative platforms for human activity concession. One goal of activity recognition is to provide information on a user's behavior that allows computing systems to actively assist users with their tasks. Human activity recognition requires running classification algorithms, originating from analytical machine learning techniques.

Md IleasPramanika, Raymond Y.K.Laua,HalukDemirkanb and Md. Abul KalamAzad[10]., Big data enabled health paradigm within smart cities these industrial developments and wide variation of ubiquitous computing enable numerous event for government and companies to reconsider healthcare anticipation. Therefore, big data and smart healthcare systems are individually attracting extensive attention from both academe and industry. The combination of both big data and smart systems can assist the prospects of the healthcare industry. The managerial conclusion of this article is that organizations can use the finding in critical analysis to boost their strategic arrangement of smart systems and big data in the healthcare situation and hence better leverage them for continual organizational invention.

J. Liao, L. Stankovic, and V. Stankovic[3]., Detecting Household Activity Patterns from Smart Meter Data an algorithm is proposed for identifying private activities from the aggregate data collected by the smart meter . Activities are those that can be describing by the smart meter data and activities can be identified from the smart meter data and substantial sensing. For identifying the individual activities dispersive the total power usage down to particular electrical appliances. An activity model is created to reason the domestic activities. This argument is done with the help of Dempster-Shafer theory of evidence. The theory states which can be incorporate evidence from different sources and appear at a degree of belief that takes into account all the available deposition. Identification of domestic activities inside a smart home has many applications.

C. Chalmers, W. Hurst, M. Mackay, and P. Fergus[4]., Smart meter profiling for health applications in which the smart meters are used to monitor electricity usage and observe sudden changes in the behavior of character inside smart homes. Its applications come in the field of tracking individual's difficulty from Alzheimer's disease, Parkinson's disease and clinical desolation. This focuses on data classification techniques which detect inconsistency in behavior by analyzing personal energy usage patterns. Here

the framework is termed as Advanced Metering Infrastructure (AMI). This is the AMI in which there is a smart home furnished with smart devices like smart meter gas, smart meter electricity and there is a smart meter that compiles data from all the smart devices. There is a data service provider inside DCC which compile data from WAN in DCC and provide it the described users like suppliers, network operators and other accredited parties like healthcare experts.

J. Clement, J. Ploennigs, and K. Kabitzsch[2]., Detecting activities of daily living with a smart meters is a research work in which smart meters are used to provide data to analyze the energy utilization of buildings and to analyze the usage of appliances. This helps the older people to stay longer separate in their homes by detecting their action and their behavior models to ensure their healthy level. There are Semi Markov Model (SMM) & Influence based method. The Semi-Markov-Model (SMM) is used to evaluate and detect individual habits to find unique structures represent habits. If the most possible executed activity (PADL) is calculated then it can infer the currently executed activity (ADL) of the inhabitant. The motivation based method is used for the detection of ADLs by analyzing all parallel ADLs. Both accesses are based on smart meter events which help to detect which home appliance was switched. Thus, this paper will also give a review of popular methods to detect the events on electricity consumption data.

III. PROPOSED MODEL

Data Preparation

The dataset used in this study is collection of smart meters data from five houses in the United Kingdom (UK). This dataset includes 400 million raw records at time decision of 6 seconds. In the first stage of the cleaning process to developed custom procedures to remove noises from the data and prepare it for mining. After cleaning and preparation, the dataset is reduced 20 million. Additionally, to develop a synthetic dataset for preliminary evaluation of the model having over 1.2 million records.

Extracting Frequent Patterns of Human Activities

As mentioned earlier, the aim is to detect human activity patterns from smart meters data. For example, activities such as “Watching the TV, Cooking, Using Computer, Preparing Food & Cleaning Clothes” are usually regular routines. The aim is to discover the patterns of these actions so that a health care application, those supervisor sudden changes in patient behavior can send timely alert to health care provider’s appliances that point out three different activities at home.

Clustering Analysis: incremental k-means

Discovering appliance-to-time associations is basic to health applications that monitor patient’s activity patterns on a daily basis. In this section, a clustering analysis mechanism is used to discover appliance usage time with respect to hour of day (00:00 to 23:59), time of day (Morning, Afternoon, Evening and Night), weekday, week and month of the year. Appliance-to-time associations are hidden information in the smart meter time series data which include sufficiently close time-stamps, when relevant appliance have been recorded as active or operational.

Bayesian Networks for Activity Prediction

To tackle the introductory issues, this paper proposes frequent mining and prediction model to measure and consider energy usage changes sparked by occupants’ behavior. The data from smart meters are frequently mined in the quantum/data slice of 24 hours and the results are maintained across consecutive mining exercises. And also utilize the Bayesian network, a probabilistic graphical model, to conclude the use of multiple appliances and household energy utilization. The proposed model is capable of short term predictions ranging from next hour up to twenty four hours and long term prediction for days, weeks, months or seasons. For evaluation of the proposed mechanism, this exploration uses the UK Domestic Appliance Level Electricity dataset (UK-Dale) - time series data of power consumption collected from 2012 to 2015 with time decision of six seconds for 5 houses with 109 appliances from Southern England. It must be noted that in practice load integrating is carried by Non-Intrusive Appliance Load Monitoring (NALM) technique. NALM is a technique using disaggregates a home’s power usage into individual appliances and labels them for further mining and analysis.

Integrate the frequent patterns and appliance-to-time associations to enroll about the use of multiple appliances and build the activity prediction model. The mechanism utilizes Bayesian network which is a directed acyclic graph, where nodes represent random variables and edges indicate probabilistic dependencies. For an example of Bayesian network is representing random variables. One of the main features of a Bayesian network is that it includes the concept of source.

IV. CONCLUSION AND FUTURE WORK

In this model observe human activities patterns from low resolution smart meters data. Occupant's habits and behavior follow a pattern that the time. From the experiment results have demonstrated suitability of the proposed model to correctly expose multiple appliance usage and make short & long term prediction at high accuracy. For future work, there are planning to clarify the model and introduce distributed learning of big data mining from multiple houses in a near real time manner. This will help health applications to directly take actions such as sending alert to patients or care providers. Furthermore, there are planning to frame a health ontology model to automatically map discovered appliances to potential activities. This means accurately train the system and increase the accuracy of detecting human activities.

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